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APPLICATION FOR UNITED STATES LETTERS PATENT

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TITLE: Television Tuner Having Input And  
Output Signals Sufficiently Isolated  
From Each Other

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TELEVISION TUNER HAVING INPUT AND OUTPUT SIGNALS  
SUFFICIENTLY ISOLATED FROM EACH OTHER

This application claims the benefit of priority to  
5 Japanese Patent Application No. 2003-000963, herein  
incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

10 The present invention relates to a television tuner. In  
particular, the present invention relates to the layout in a  
television tuner suitable for a dual-screen television  
receiver for splitting an input television signal into two  
television signal components, one of which is converted to  
15 an intermediate-frequency signal component and the other of  
which is output externally.

2. Description of the Related Art

Fig. 2 is a schematic plan view showing the layout of  
component blocks of a known television tuner. The known  
20 television tuner includes a box-shaped metal frame 51 having  
a first side plate 51a; a second side plate 51b opposite to  
the first side plate 51a; a third side plate 51c; and a  
fourth side plate 51d. The television tuner further  
includes a first shield plate 52; a second shield plate 53;  
25 a third shield plate 54; and a fourth shield plate 55. The  
shield plates 52 to 54 are disposed parallel to one another  
in that order from the third side plate 51c to the fourth  
side plate 51d, and bridge the side plates 51a and 51b. The

fourth shield plate 55 bridges the shield plates 53 and 54.

The area inside the metal frame 51 is divided into a first compartment 56 between the third side plate 51c and the first shield plate 52; a second compartment 57 between  
5 the first shield plate 52 and the second shield plate 53; a third compartment 58 enclosed by the first side plate 51a, the second shield plate 53, the third shield plate 54, and the fourth shield plate 55; a fourth compartment 59 enclosed by the second side plate 51b, the second shield plate 53,  
10 the third shield plate 54, and the fourth shield plate 55; and a fifth compartment 60 between the third shield plate 54 and the fourth side plate 51d.

In the metal frame 51, the shield plates 52 to 55 stand upright (i.e. the height direction is in the plane of the  
15 paper, from the second side plate 51b to the first side plate 51a) and circuit boards (not shown) for mounting various circuits are disposed in the compartments 56 to 60.

The third side plate 51c has a first connector 61, which is a television-signal-receiving connector, mounted thereon  
20 at a portion adjacent to the first side plate 51a. The first side plate 51a has a second connector 62, which is a television-signal-outputting connector, mounted thereon at a portion interfacing with the first compartment 56. The second side plate 51b has a plurality of terminals 63  
25 mounted in line thereon such that the terminals 63 are separated from one another at substantially identical intervals.

The reason for the first connector 61 being disposed

adjacent to the first side plate 51a is to ensure a sufficient height of the first connector 61 from the second side plate 51b when the motherboard (not shown) of a television receiver is connected to the terminals 63.

5       The first compartment 56 contains a first wideband amplifier 64 for amplifying an input television signal; a distributor 65 for splitting the television signal into two television signal components; and a second wideband amplifier 66 for amplifying one of the two television signal  
10 components. The first wideband amplifier 64 is disposed close to the first connector 61. The distributor 65 is disposed between the second connector 62 and the first wideband amplifier 64 such as to be close to the second connector 62. The second wideband amplifier 66 is disposed  
15 opposite to the distributor 65 with respect to the first wideband amplifier 64; in other words, the second wideband amplifier 66 is disposed adjacent to the second side plate 51b.

      The second to fifth compartments 57 to 60 contain  
20 circuits constituting a tuning section. In detail, the second compartment 57 contains an input tuning circuit 67, which includes a tuning circuit for the UHF and VHF bands. The input tuning circuit 67 has its input terminal disposed adjacent to the first side plate 51a.

25       Underneath the second shield plate 53 (on the bottom surface of the circuit board) are provided a UHF amplifier 68 and a VHF amplifier 69. The third compartment 58 contains a UHF-band interstage tuning circuit 70 and the

fourth compartment 59 contains a VHF-band interstage tuning circuit 71. The fifth compartment 60 contains an oscillator 72 and a mixer 73.

In the known television tuner described above, a  
5 television signal input to the first wideband amplifier 64 via the first connector 61 is split into two television signal components in the distributor 65. One of the two television signal components is input to the input tuning circuit 67 via the second wideband amplifier 66. The  
10 television signal component is converted to an intermediate-frequency signal in the mixer 73 and is finally output from the terminals 36. The other of the two television signal components split in the distributor 65 is output from the second connector 62 to another television tuner.

15 In the known television tuner described above, the distance between the third side plate 51c and the first shield plate 52 is small, i.e., the area of the first compartment 56 is small. For this reason, the second wideband amplifier 66 is disposed opposite to the  
20 distributor 65 with respect to the first wideband amplifier 64; in other words, the second wideband amplifier 66 is disposed adjacent to the second side plate 51b. Thus, when a television signal output from the first wideband amplifier 64 is passed to the distributor 65 and one of the two  
25 television signal components split in the distributor 65 is input to the input tuning circuit 67 via the second wideband amplifier 66, the television signal travels first in one direction, then in the opposite direction, and again in the

one direction. This causes the distributor 65 to have its input and output terminals poorly isolated from each other and the second wideband amplifier 66 to have its input and output terminals poorly isolated from each other, resulting  
5 in the television signal entering the input tuning circuit 67 being poorly isolated from the television signal output to the second connector 62. Thus, channel switching undesirably causes noise to be mixed with another, externally connected tuner.

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#### SUMMARY OF THE INVENTION

Accordingly, an embodiment of the present invention provides a television tuner in which two split television signal components, one entering the tuning section and the  
15 other being provided essentially directly to an external terminal, are sufficiently isolated from each other.

According to an aspect of the present invention, a television tuner includes a conductive frame having a first side plate, a second side plate opposite to the first side  
20 plate, a third side plate, and a fourth side plate. A first shield plate divides the frame into a first division adjacent to the first side plate and a second division adjacent to the second side plate. A distributing section includes at least a distributor that splits one television  
25 signal into two television signal components. A tuning section converts the frequency of a first of the two television signal components into an intermediate-frequency signal. A first connector receives the television signal

and a second connector outputs the second television signal component. In this television tuner, the first connector is disposed on the third side plate at a portion forming the first division, the second connector is disposed on the  
5 first side plate, the distributing section is disposed in the first division, and the tuning section is disposed in the second division. As a result, the two television signal components propagate in opposite directions to each other, one to the second connector and the other to the tuning  
10 section. Therefore, the two signal components hardly interfere with each other, ensuring isolation between the two signal components.

The distributing section may include a first wideband amplifier connected between the first connector and the  
15 distributor. The first wideband amplifier is disposed in the first division and close to the first connector and the distributor is disposed between the first wideband amplifier and the fourth side plate such as to be adjacent to the first wideband amplifier. As a result, the noise figure  
20 (NF) due to distribution loss can be reduced and the first wideband amplifier can have its input and output sufficiently isolated from each other.

The television tuner may include a second wideband amplifier connected between the distributor and the tuning  
25 section. The second wideband amplifier is disposed between the distributor and the shield plate such as to be close to the distributor. As a result, the television signal can be input to the tuning section along the shortest possible

route, and the signal coming to the tuning section can be sufficiently isolated from the signal propagating in the opposite direction with respect to the distributor.

The television tuner may include a third wideband  
5 amplifier connected between the distributor and the second connector. The third wideband amplifier is disposed between the distributor and the first side plate or the fourth side plate such as to be adjacent to the distributor, and the second connector is disposed on the first side plate at a  
10 portion interfacing with the third wideband amplifier. As a result, the television signal can be input to the second connector along the shortest possible route, and the signal sent to the second connector can be sufficiently isolated from the signal propagating in the opposite direction with  
15 respect to the distributor.

The distributing section may further comprise a first wideband amplifier connected between the first connector and the distributor in which the first wideband amplifier is disposed in the first division and is closer to the first  
20 connector than other electronic components in the first division, and the distributor is disposed between the first wideband amplifier and the fourth side plate and is adjacent to the first wideband amplifier. In this case, the television tuner may further comprise a second wideband  
25 amplifier connected between the distributor and the tuning section, and which is disposed between the distributor and the first shield plate and/or a third wideband amplifier connected between the distributor and the second connector



and which is disposed between at least one of the distributor and the first side plate and between the distributor and the fourth side plate.

The distributing section may comprise a plurality of  
5 wideband amplifiers disposed such that a first of the wideband amplifiers is connected between the distributor and the first connector, a second of the wideband amplifiers is connected between the distributor and the second connector, and a third of the wideband amplifiers is connected between  
10 the distributor and the tuning section. In this case, the television signal components from the second of the wideband amplifiers to the second connector and from the third of the wideband amplifiers to the tuning section may propagate primarily in opposite directions.

15 In fact, in the television tuner, the television signal components from the distributor to the second connector and from the distributor to the tuning section may or may not propagate in the same direction.

The tuning section may include an input tuning circuit,  
20 an interstage tuning circuit, an oscillator, a mixer, a second shield plate bridging the first shield plate and the second side plate, and a third shield plate bridging the first shield plate and the fourth side plate. The second division then contains a first compartment bounded by the  
25 third side plate and the second shield plate and that encloses the input tuning circuit, a second compartment bounded by the second shield plate and the third shield plate and that encloses the interstage tuning circuit and

the mixer, and a third compartment bounded by the first shield plate, the third shield plate, and the fourth side plate and that encloses the oscillator. The third shield plate may be L-shaped and/or the tuning section include a high-frequency amplifier connected between the input tuning circuit and the interstage tuning circuit.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a plan view showing the layout of component blocks of a television tuner according to the present invention; and

Fig. 2 is a plan view showing the layout of component blocks of the known television tuner.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 is a schematic plan view showing the layout of component blocks of a television tuner according to the present invention. The television tuner includes a box-shaped metal frame 1 having a first side plate 1a; a second side plate 1b opposite to the first side plate 1a; a third side plate 1c; and a fourth side plate 1d. The television tuner further includes a first shield plate 2 which is parallel with the second side plate 1b and bridges the third side plate 1c and the fourth side plate 1d. The area inside the metal frame 1 is divided into a first division 3 between the first side plate 1a and the first shield plate 2 and a second division 4 between the second side plate 1b and the first shield plate 2.

The television tuner further includes a second shield plate 5 bridging the first shield plate 2 and the second side plate 1b; and an L-shaped third shield plate 6 bridging the first shield plate 2 and the fourth side plate 1d. The  
5 second division 4 is further divided into a first compartment 7 between the third side plate 1c and the second shield plate 5; a second compartment 8 between the second shield plate 5 and the third shield plate 6; and a third compartment 9 enclosed by the first shield plate 2, the  
10 third shield plate 6, and the fourth side plate 1d.

In the metal frame 1, the shield plates 2, 5, and 6 stand upright and circuit boards (not shown) for mounting various circuits are disposed in the first division 3 and the second division 4 (the compartments 7 to 9). The  
15 compartments 7 to 9 have different sizes from each other and may be sized to minimize the amount of space used by the metal frame 1.

The third side plate 1c has a first connector 10, which is a television-signal-receiving connector, mounted thereon  
20 at a portion interfacing with the first division 3. The first side plate 1a has a second connector 11, which is a television-signal-outputting connector, mounted thereon. The second side plate 1b has a plurality of terminals 12 mounted in line thereon such that the terminals 12 are  
25 separated from one another at substantially identical intervals.

One reason for the first connector 10 being disposed at a position interfacing with the first division 3 is to

ensure a sufficient distance of the first connector 10 from the second side plate 1b when the motherboard (not shown) of a television receiver is connected to the terminals 12.

The first division 3 contains a distributing section 13 for splitting an input television signal into two television signal components. The distributing section 13 includes a first wideband amplifier 13a for amplifying an input television signal; a distributor 13b for splitting the amplified television signal into two television signal components; a second wideband amplifier 13c for amplifying one of the two television signal components; and a third wideband amplifier 13d for amplifying the other television signal component. While the embodiment illustrated in Fig. 1 shows multiple wideband amplifiers, the first, second, and third wideband amplifiers 13a, 13c, and 13d may not be essential. The first wideband amplifier 13a preceding the distributor 13b is advantageous in reducing the noise figure (NF) due to distribution loss.

The first wideband amplifier 13a is disposed adjacent to the first connector 10. The distributor 13b is disposed between the first wideband amplifier 13a and the fourth side plate 1d such as to be adjacent to the first wideband amplifier 13a.

The second wideband amplifier 13c is disposed between the distributor 13b and the first shield plate 2 such as to be adjacent to the distributor 13b. The third wideband amplifier 13d is disposed between the distributor 13b and the fourth side plate 1d or the first side plate 1a such as

to be adjacent to the distributor 13b. The second connector 11 is disposed at a portion on the first side plate 1a adjacent to the third wideband amplifier 13d.

The second division 4 contains a tuning section 14, which includes an input tuning circuit 14a, a high-frequency amplifier 14b, an interstage tuning circuit 14c, an oscillator 14d, a mixer 14e, and other components (not shown). The input tuning circuit 14a includes a tuning circuit for the UHF band and a tuning circuit for the VHF band, and is disposed at a portion in the first compartment 7 adjacent to the second wideband amplifier 13c. The high-frequency amplifier 14b includes two circuits for the UHF band and the VHF band, and is disposed underneath the second shield plate 5 (on the bottom surface of the circuit board). The interstage tuning circuit 14c also includes a tuning circuit for the UHF band and a tuning circuit for the VHF band, and is disposed in the left-half area (adjacent to the second shield plate 5) of the second compartment 8. The oscillator 14d is disposed in the third compartment 9. The mixer 14e is disposed in the right-half area (adjacent to the fourth side plate 1d) of the second compartment 8.

In the television tuner described above, a television signal input to the first wideband amplifier 13a via the first connector 10 is amplified and then split into two television signal components in the distributor 13b. One of the two television signal components is input to the input tuning circuit 14a in the first compartment 7 via the second wideband amplifier 13c. The television signal component is

input to the mixer 14e via the high-frequency amplifier 14b and the interstage tuning circuit 14c, is mixed with an oscillating signal into an intermediate-frequency signal in the mixer 14e, and is finally output from the terminals 12.

- 5 The other of the two television signal components split in the distributor 13b is output from the second connector 11 to another television tuner via the third wideband amplifier 13d.

In the television tuner described above, one of the two  
10 television signal components split in the distributor 13b goes into the second division 4, which is shielded from the first division 3 by the first shield plate 2, whereas the other television signal component goes into the second connector 11 on the first side plate 1a. Thus, the two  
15 television signal components propagate primarily in opposite directions to each other, and therefore hardly interfere with each other. In addition, the two television signal components pass through the respective wideband amplifiers 13c and 13d, and hence the interference between the  
20 television signal components at the outputs of the wideband amplifiers 13c and 13d is further reduced, ensuring isolation between the television signal components.